

**Listing of Claims:**

This listing of claims will replace all prior versions and listings of claims in the application.

1. (Previously Presented) A selective hydrogenation catalyst consisting essentially of:  
a precursor comprising at least one Group VIII metal disposed on an inorganic support;  
and  
a second metal selected from the group consisting of zinc, Group IIIA metals, Mn, and combinations thereof, disposed on the precursor;  
wherein the catalyst comprises between 0.01 and 10 weight % Group VIII metal, and is capable of selectively hydrogenating acetylene with a conversion  $S_c$  of at least about 95% and a selectivity to ethylene relative to ethane  $S_s$  of at least about 25 when the catalyst is employed in a steady-state liquid phase hydrogenation process.
2. (Original) The catalyst of claim 1 wherein the inorganic support comprises alumina.
3. (Original) The catalyst of claim 2 wherein the inorganic support comprises a particulate support.
4. (Original) The catalyst of claim 1 wherein the at least one Group VIII metal comprises palladium.
5. (Canceled).
6. (Previously Presented) The catalyst of claim 1 wherein the second metal comprises Zn.
- 7 - 9. (Canceled).
10. (Original) The catalyst of claim 4 wherein the second metal is selected from the group consisting of Group IIIA metals, and combinations thereof.

11. (Previously Presented) The catalyst of claim 10 wherein the second metal is selected from the group consisting of In, Ga, and combinations thereof.
12. (Previously Presented) The catalyst of claim 4 wherein the second metal comprises a metal selected from the group consisting of In, Ga, Mn, Zn, and combinations thereof.
13. (Original) The catalyst of claim 12 wherein the catalyst is capable of sustained activity for acetylene hydrogenation for at least about 150 hours.
14. (Currently Amended) A composition consisting essentially of:
  - a support;
  - a Group VIII metal disposed on the support; and
  - a second metal selected from the group consisting of Group IIIA metals, zinc, Mn, and combinations thereof, disposed on the Group VIII metal and disposed on the support;wherein the concentration of said Group VIII metal is within the range of from about 0.01 wt-% to about 10 wt-%[[.]], and wherein said composition is characterized by sustained activity for selective hydrogenation of at least about 150 hours.
15. (Original) The composition of claim 14 wherein said sustained activity for selective hydrogenation comprises sustained activity for liquid-phase selective hydrogenation.
16. (Original) The composition of claim 15 wherein said selective hydrogenation comprises selective hydrogenation of acetylene.
17. (Canceled).
18. (Original) The composition of claim 16 further comprising a selectivity of ethylene relative to ethane  $S_s$  greater than or equal to about 25.

19. (Original) The composition of claim 18 further comprising an acetylene conversion  $S_c$  of about 95% or greater.

20. (Original) The composition of claim 16 wherein the second metal is selected from the group consisting of Mn, In, Ga, Zn, and combinations thereof.

21-22. (Canceled).

23. (Previously presented) The composition of claim 14 wherein the concentration of said Group VIII metal is within the range of from about 0.2 wt-% to about 0.8 wt-%.

24. (Original) The composition of claim 23 wherein the concentration of said Group VIII metal is within the range of from about 0.2 wt-% to about 0.5 wt-%.

25. (Previously presented) The composition of claim 14 wherein the concentration of said second metal is within the range of from about 0.05 wt-% to about 2.0 wt-%.

26. (Original) The composition of claim 25 wherein the concentration of said second metal is within the range of from about 0.05 wt-% to about 1.2 wt-%.

27. (Original) The composition of claim 26 wherein the concentration of said second metal is within the range of from about 0.05 wt-% to about 1.0 wt-%.

28. (Original) The composition of claim 27 wherein the concentration of said second metal is within the range of from about 0.05 wt-% to about 0.5 wt-%.

29. (Original) The composition of claim 28 wherein the concentration of said second metal is within the range of from about 0.1 wt-% to about 0.5 wt-%.

30. (Original) The composition of claim 29 wherein the second metal is selected from the group consisting of Mn, In, Ga, Zn, and combinations thereof.

31. (Canceled).

32. (Original) The composition of claim 29 wherein the Group VIII metal comprises Pd.

33. (Original) The composition of claim 32 wherein the second metal is selected from the group consisting of Mn, In, Ga, Zn, and combinations thereof.

34. (Canceled).

35. (Original) The composition of claim 33 wherein the second metal comprises In or Ga.

36. (Original) The composition of claim 33 wherein the second metal comprises Zn.

37. (Previously presented) A catalyst active for liquid-phase selective hydrogenation consisting essentially of:

Pd supported on particulate alumina; and

a subsequently supported second metal comprising Mn, and one selected from the group consisting of Ga, In, Zn, and combinations thereof; the catalyst having:

a once-through acetylene conversion  $S_c$  of at least about 95%; and

a selectivity for ethylene relative to ethane  $S_s$  of at least about 40, and a concentration of palladium within the range of from about 0.01 wt-% to about 10 wt-%.

38. (Original) The catalyst of claim 37 further comprising a sustained activity for selective hydrogenation of at least 150 hours.

39. (Original) The catalyst of claim 38 wherein the second metal comprises from about 0.05 % to about 1 % of the catalyst by weight.

40. (Canceled).

41. (Previously presented) The catalyst of claim 37 wherein the Pd comprises from about 0.2 % to about 0.5 % of the catalyst by weight.

42. (Original) The catalyst of claim 39 wherein the second metal comprises from about 0.05 % to about 0.5 % of the catalyst by weight.

43. (Original) The catalyst of claim 42 wherein the Pd comprises from about 0.1 % to about 1.0 % of the catalyst by weight.

44. (Original) The catalyst of claim 43 wherein the Pd comprises from about 0.2 % to about 0.5 % of the catalyst by weight.

45. (Canceled).

46. (Original) The catalyst of claim 44 wherein the second metal is In or Ga.

47. (Original) The catalyst of claim 44 wherein the second metal is Zn.

48. (Canceled).

49. (Original) The catalyst of claim 38 wherein the second metal is In or Ga.

50. (Original) The catalyst of claim 38 wherein the second metal is Zn.

51. (Previously Presented) A supported catalyst for selective hydrogenation consisting essentially of:

a support coated with a Group VIII metal and a second metal selected from the group consisting of gold, silver, zinc, Group IIIA metals, Mn, and combinations thereof disposed on the support, wherein the concentration of the Group VIII metal is within the range of from about 0.01 wt-% to about 10 wt-%; and

having a single-pass conversion  $S_c$  of at least 90% in liquid-phase hydrogenation of acetylene.

52. (Previously Presented) The catalyst of claim 51 wherein the second metal is selected from the group consisting of Group IIIA metals, zinc, Group VIIB metals, and combinations thereof.

53. (Original) The catalyst of claim 52 further comprising a selectivity for ethylene relative to ethane  $S_s$  of at least 40.

54. (Original) The catalyst of claim 53 wherein the second metal comprises about 0.05 wt-% to 1.0 wt-% of the catalyst by weight.

55. (Original) The catalyst of claim 54 wherein the second metal comprises about 0.1 wt-% to 0.5 wt-% of the catalyst by weight.

56. (Original) The catalyst of claim 55 further comprising a sustained activity for selective hydrogenation of acetylene of about 150 hours or greater.

57. (Original) The catalyst of claim 56 wherein the second metal is selected from the group consisting of Ga, Mn, In, Zn, and combinations thereof.

58. (Original) The catalyst of claim 57 wherein the Group VIII metal and the second metal are applied to the catalyst sequentially.

59. (Original) The catalyst of claim 58 wherein the second metal is applied to the catalyst after the Group VIII metal.

60. (Original) The catalyst of claim 57 wherein the second metal and the Group VIII metal are applied to the catalyst at about the same time.

61. (Original) The catalyst of claim 59 wherein the Group VIII metal is Pd.

62. (Original) The catalyst of claim 61 wherein the catalyst comprises an alumina support.

63. (Original) The catalyst of claim 62 wherein the support is a particulate support.

64. (Original) The catalyst of claim 63 wherein the particles have a minimum dimension between about 0.01 in. and about 0.2 in.

65. (Original) The catalyst of claim 64 wherein the particles have a minimum dimension between about 0.01 in. and about 0.02 in.

66. (Previously Presented) A supported catalyst for selective hydrogenation consisting essentially of:

a first metal selected from the group consisting of Group VIII metals and combinations thereof, disposed on the support; and

a second metal selected from the group consisting of Group IIIA metals, zinc, Mn, and combinations thereof;

said first and second metals being disposed on the support, wherein the concentration of first metal is within the range of from about 0.01 wt-% to about 10 wt-% and wherein the

supported catalyst has an ethylene selectivity relative to ethane  $S_s$  of at least 20 in liquid-phase hydrogenation of acetylene.

67. (Previously Presented) The catalyst of claim 66 wherein the molar ratio of the amounts of the first metal to the second metal in the catalyst is from about 6 to about 0.25.

68. (Previously Presented) The catalyst of claim 67 wherein the molar ratio of the amounts of the first metal to the second metal in the catalyst is from about 3 to about 0.5.

69. (Original) The catalyst of claim 68 wherein the Group VIII metal is palladium.

70. (Original) The catalyst of claim 69 wherein the second metal is Zn.

71. (Canceled).

72. (Original) The catalyst of claim 69 wherein the second metal is selected from the group consisting of Group IIIA metals and combinations thereof.

73. (Original) The catalyst of claim 72 wherein the second metal is selected from the group consisting of In, Ga, and combinations thereof.

74. (Original) The catalyst of claim 73 wherein the ethylene selectivity relative to ethane  $S_s$  is greater than 40.

75. (Original) The catalyst of claim 74 further comprising a sustained activity in selective hydrogenation of greater than 100 hours.

76. (Original) The catalyst of claim 75 further comprising an acetylene conversion  $S_c$  greater than or equal to 90%.



77. (Original) The catalyst of claim 76 further comprising an acetylene conversion  $S_c$  greater than 95%.

78-111. (Canceled).

112. (Previously Presented) A hydrogenation catalyst made by a process comprising:  
applying a first metal to a support;  
applying a second metal to the support;  
drying the first and second metal-coated support;  
calcining the dried first and second metal-coated support to provide a precursor; and  
reducing the precursor;  
wherein the first metal comprises a Group VIII metal and wherein the second metal is selected from the group consisting of Group IIIA metals, zinc, Mn, and combinations thereof;  
wherein the hydrogenation catalyst consists essentially of the support, 0.01% – 10% by weight of the first metal to final weight of the catalyst and 0.05% - 1.2% by weight of the second metal to final weight of the catalyst; and  
wherein said first and second metals are applied such that the catalyst is capable of a sustained activity for selective hydrogenation of at least 150 hours and a once-through conversion  $S_c$  of at least 95% in liquid-phase hydrogenation of acetylene.

113. (Previously presented) The catalyst of claim 112 wherein the first and second metals are applied to the support concurrently.

114. (Previously Presented) The catalyst of claim 112 wherein the second metal further comprises a metal selected from the group consisting of Group IIIA metals, zinc, Group VIIB metals, and combinations thereof, and applied to provide 0.1% - 0.5% by weight of second metal to final weight of the catalyst.

115. (Previously Presented) The catalyst of claim 114 wherein the second metal further comprises a metal selected from the group consisting of In, Ga, Zn, and combinations thereof.

116. (Previously presented) The catalyst of claim 115 wherein the second metal comprises Zn.

117. (Previously presented) The catalyst of claim 115 wherein the first metal comprises Pd.

118. (Previously presented) The catalyst of claim 115 further comprising reducing the precursor for 1 – 2 hours at a temperature in the range of from about 100°C to about 425°C in an atmosphere consisting of an approximately 2:1 mixture of H<sub>2</sub>:CO at about 250 psig.

119. (Previously presented) The catalyst of claim 115 wherein the selective hydrogenation reaction conditions comprise a temperature in the range of about 100°C to about 150°C, and a pressure of from about 150 psig to about 250 psig.